

## CONTROL SYSTEM FOR THE OPERATION OF A KITCHEN OVEN

Field of the Invention

The present invention refers to a system developed to allow the electronic control of the operating times of a kitchen oven, as a function of the cooking temperature conditions pre-selected by the user. The present control system can be applied to gas or electric ovens, mounted in single cabinets or which are combined with kitchen stoves comprising a cook top provided with one or more burners or heaters.

Prior Art

The instructions provided with the packages of most food products of fast preparation, such as the frozen food products, recommend the consumer to preheat the oven before he/she introduces the food product therein to start cooking. Preheating the kitchen oven is thus an important step in the cooking process.

In the known kitchen ovens, the consumer has to use a clock or chronometer, which is provided separate from or incorporated in the cabinet of the oven, in order to be informed by the visual/audible alarm of the clock that the oven is already in the desired operating temperature, which is generally preset by the user in a thermostatic valve or in an also thermostatic energization control.

Even in the case the user is informed about the heating time of the oven for each selected temperature level, he/she has to analyze a table indicative of the operating temperature and the preheating time, in order to have the definition of the time to be adjusted in the clock or chronometer. This procedure is laborious and requires certain cares with which the user is not familiar, i.e., different from those procedures directly related to the preparation of the food product. The preheating time has to be calculated

and adjusted in an auxiliary device (clock).

There are also known the oven operation control systems which use one or more temperature sensors associated with electronic commands, which process the  
5 signals received from the sensors, instructing the gas or electric supply adjusting means, as well as visual and audible alarm means associated with timers, to operate as a function of the temperature and time conditions adjusted by the user.

10 This system with electronic sensors allows a precise operational control of the oven to be obtained, without requiring additional cares or procedures from the user, except the simple actuation of the command button of the oven for the position indicative of the  
15 desired operating temperature. However, these systems present a high cost, which substantially increases the final cost of the oven or stove associated therewith. There are well known from the art the kitchen ovens comprising a cooking chamber, inside which are mounted  
20 at least one heat source in the form of a gas burner or of an electric resistance, and a temperature sensor; and a thermostatic control device, which controls the energization of the heat source, in the form of a thermostatic valve for controlling the gas  
25 flow, or in the form of a thermostat, and which is operatively associated with a scale of the oven operating temperatures and with the temperature sensor, in order to adjust the energy supplied to the heat source, as a function of the temperature set in  
30 said device upon the activation of the oven and of the temperature sensed by the temperature sensor inside the cooking chamber. This known construction allows the user to control the operating temperature of the oven, upon completion of the preheating phase.

35 Nevertheless, there still persists the difficulty in

providing, at a low cost, a control system which is able to determine and automatically inform the user about the end of the preheating phase, with the cooking chamber being in the desired operating temperature.

#### Objects of the Invention

As a function of the limitations related to operation and cost presented by the known control systems, it is an object of the present invention to provide a system of the type exemplified above, which is able to supply the user, by means of a relatively simple construction, with an automatic visual and audible indication that the cooking chamber of the oven has reached the operating temperature which has been set upon the activation of the oven.

It is a more specific object of the present invention to provide a control system such as mentioned above, which has its operation automatically started when the user switches on the oven.

It is a further object of the present invention to provide a control system as defined above, which can be operatively associated with other functions, such as time control and operational safety of the oven, as well as other heat sources of a stove associated therewith.

#### Disclosure of the Invention

In order to attain the above-mentioned objects, the invention is applied to a control system for the operation of a kitchen oven as defined above, which comprises, besides the usually known control elements, a decoder which is operatively associated with the thermostatic control device in order to produce a digital signal for each temperature preset in the thermostatic control device; and an electronic control module comprising a processing unit, an initial

heating timer, a digital display and an audible alarm, operatively associated with each other.

The processing unit is connected to the decoder so as to receive therefrom and to process a digital signal indicative of the activation of the oven and of the selected operating temperature, in order to activate the audible alarm when a pre-established initial heating time has elapsed, so that the cooking chamber can reach the selected operating temperature.

The basic construction proposed herein allows the user to be informed about the moment in which the oven is in a pre-selected temperature condition, without requiring any additional operation for activating the oven, such as moving the thermostatic control device toward the open position at the desired temperature.

#### Brief Description of the Drawings

The invention will be described below, with reference to the enclosed drawing, given by way of example of a possible embodiment of the present system and in which:

Figure 1 is a schematic diagram of the present control system, applied to a kitchen oven associated with a cook top, and in which the heat sources of both the oven and the cook top are defined by gas burners.

#### Description of the Invention

As mentioned above and illustrated in the single figure of the enclosed drawing, the present control system is applied to a kitchen oven of the type which comprises a cooking chamber 11, within which a heat source 20 and a temperature sensor 30 are lodged. The oven 20 can be defined in a single cabinet, or mounted in a cabinet, on which upper portion is defined a stove cook top, comprising one or more heat sources 20 for cooking.

The control system of the invention is applied to

ovens presenting gas or electric burners and whose operation is determined by a thermostatic control device 40, external to the cooking chamber and which is operatively associated with an energy source 1, with the heat source 20 of the cooking chamber 11, and with the temperature sensor 30, in order to control the energy supplied to the heat source 20 as a function of the operating temperature to which it has been selectively adjusted and of the temperature detected by the temperature sensor 30.

In the illustrated construction, the heat source 20 is defined by a gas burner and the thermostatic control device is defined by a thermostatic valve, incorporating an electromagnetic obturator 41 and which is connected to a thermocouple 42 mounted close to the heat source 20 so as to be heated by the flame produced by the gas burner in operation, maintaining the electromagnetic obturator 41 in the open condition, to which it has been mechanically manually conducted by the user operating the thermostatic control device 40.

Nevertheless, it should be understood that the heat source 20 could be defined by an electric resistance, in which situation the thermostatic control device 40 consists in a thermostat coupled to the temperature sensor 30, but without the electromagnetic obturator 41.

Independently of the type of energy supplied to the heat source 20, the thermostatic control device 40 comprises a driving rod 43, to which is affixed a knob 44 to be operated by the user, generally by rotation, and which is associated with a scale 45 containing different operating temperatures for the oven 10 which are printed on a control panel (not illustrated) provided in the cabinet of the oven 10 where the knob

44 is located.

According to one aspect of the invention, a decoder 50 preferably of the type which uses the Gray Codification, is mounted to the driving rod 43 of the  
5 thermostatic control device 40, or otherwise operatively associated with the latter, in order to produce a digital signal for each temperature of the scale 45 adjusted in said thermostatic control device 40. Thus, when the user operates the knob 44 to  
10 energize the heat source 20, displacing it to a position corresponding to a chosen operating temperature indicated in the scale 45, the decoder 50 will be correspondingly displaced, in order to produce, automatically, a digital signal indicative of  
15 the operating temperature selected by the user in the thermostatic control device 40.

In order to allow the digital signal produced by the decoder 40 to be used in the determination of the initial heating time of the cooking chamber 11 until  
20 the selected operating temperature is reached, the control system further comprises an electronic control module M which is energized by an electric energy source 2 external to the oven 10. The electronic control module M comprises a processing unit 60, an  
25 initial heating timer  $T_{in}$ , which can be provided in the interior of the processing unit in a time base with adequate precision (for example, the frequency of the AC electric power network, crystal oscillators of the type used in clocks, etc.), a digital display 70,  
30 and an audible alarm 80 operatively associated with each other.

The processing unit 60 is connected to the decoder 50 so as to receive therefrom and to process the digital signal indicative of the activation of the oven and of  
35 the selected temperature, in order to activate the

audible alarm 80, when a pre-established initial heating time has elapsed, so that the cooking chamber 11 reaches the selected operating temperature.

In a preferred constructive form, the processing unit  
5 60 is programmed to indicate, in the display 70, the selected operating temperature, when the pre-established initial heating time has elapsed in the processing unit 60 as a function of the digital signal received from the decoder 50.

10 Also a preferred form of processing the signals takes into account the recent historic information about the times elapsed since the activation and deactivation of the oven, allowing to recalculate the remaining time for the preheating, based on a situation in which said  
15 oven is already at a temperature superior to that of the environment, thus promoting an effective economy of time and energy to the user.

The temperature sensor 30 can take the form of a sensor bulb, directly coupled to the thermostatic  
20 control device 40 in order to operate the latter, increasing or decreasing the energy flow (gas or electricity) supplied to the heat source 20, as a function of the temperature condition sensed by the sensor bulb inside the cooking chamber 11.

25 In a preferred form of the invention, the electronic control module M further comprises a timer T which is operatively associated with the processing unit, with the digital display 70, and with the audible alarm 80 so as to indicate, in the digital display 70, the time  
30 elapsed to be controlled by the user, and to make the audible alarm 70 ring when the time preset in the timer T has elapsed.

The present control system may have its electronic control module M comprising an operation timer Top,  
35 which is operatively associated with the processing

unit 60, with the digital display 70, with the audible alarm 80, and with the thermostatic control device 40, in order to indicate, in the digital display 70, the count of an operating time of a heat source 20 preset  
5 by the user, making the audible alarm 80 ring and interrupting the energization of the heat source 20 at the end of the time selectively set in the operation timer Top.

In the cases in which the heat source 20 takes the  
10 form of a gas burner, the electromagnetic obturator 41 is connected to the thermocouple 42 by means of an electronic switch R, generally a normally closed relay, provided in the electronic control module M and which is connected to the processing unit 60 so as to  
15 be opened, interrupting the energization of the electromagnetic obturator 41 and blocking the supply of gas to the heat source 20, upon completion of the time of the operation timer Top selectively adjusted by the user.

20 The electronic control module M can further comprise at least one additional operation timer Tad, which is operatively associated with the processing unit 60, with the digital display 70, with the audible alarm 80 and with a control device 90, connecting the energy  
25 source 1 to an additional heat source 20a defined in a cook top associated with the oven 10, the additional operation timer Tad indicating, in the digital display 70, the count of the operating time of the additional heat source 20a adjusted by the user, making the  
30 audible alarm 80 ring and interrupting the energization of the additional heat source 20a at the end of the time selectively preset in the additional operation timer Tad.

In the case in which the additional heat source is a  
35 gas burner, and the control device 90 is a valve



incorporating an electromagnetic obturator 41, the present control system further comprises the provision of a thermocouple 42, associated with the additional heat source 20a and which is electrically connected to the electromagnetic obturator 41 by an additional electronic switch Rad, which is normally closed and generally in the form of a relay provided in the electronic control module M and which is connected to the processing unit 60 in order to be opened, interrupting the energization of the electromagnetic obturator 41 and blocking the supply of gas to the additional heat source 20a, upon completion of the time selectively adjusted by the user in the additional operation timer Tad.

In the cases in which the energy used for heating is the electric energy, with the heat sources 20 and 20a, if existing, being defined by electric resistances, the electromagnetic obturator 41 and the thermocouple 42 are not provided.

In this case, the interruption of energy supply to each heat source 20, 20a is produced by an operation timer associated with the processing unit 60, in order to instruct the latter to interrupt, through a corresponding electronic switch, the passage of electric energy which supplies the respective heat source.

As it can be noted, the present control system allows the user to be informed of the moment in which the cooking chamber 11 of the oven 10 is found at a pre-set operating temperature level, this information being obtained by the selected operating temperature being indicated to the processing unit 70 by the decoder 50, and also by means of the information stored in the processing unit and which associate, with each operating temperature, an initial heating

time which has been previously defined as a function of the constructive characteristics of each oven 10. Thus, after defining the operating temperature and starting the operation of the oven, the processing unit associates, with the selected operating temperature, an initial heating time to be controlled by the initial timer, so as to activate the audible alarm 80 upon completion of said initial heating time processed in the processing unit 70.

10 Aiming at guaranteeing an adequate operation of the elements indicative of the temperature status of the oven, the present control system presents, preferably, a means for checking the time elapsed between a last operation of the oven and a new operation being

15 programmed. Therefore, the initial heating time for the cooking chamber 11 is preferably defined by the processing unit 60 also as a function of the time elapsed since the last deactivation of the oven 10 in the thermostatic control device 40 and which is

20 measured by the operation timer Top. Thus, if the operating time elapsed since the last switching-off of the oven 10 is shorter than a determined period of time considered sufficient for a determined cooling degree of the cooking chamber, the initial heating

25 time of the new operation of the oven will be calculated considering a certain residual temperature which is computed as a function of said time interval indicated by the operation timer.

While only one embodiment of the present control

30 system has been illustrated herein, it should be understood that changes in the form and arrangement of the elements could be made, without departing from the protective scope defined in the appended claims.